

May 2, 2013

Ms. Brenda Edwards
U.S. Department of Energy
Building Technologies Program
Suite 600
950 L'Enfant Plaza, SW
Washington, DC 20024

Re: AHRI Comments on DOE Supplemental Notice of Proposed Rulemaking on Test Procedures for Residential Furnace Fans [Docket No. EERE-2010-BT-TP-0010/RIN 1904-AC21]

Dear Ms. Edwards:

These comments are submitted by the Air-Conditioning, Heating, and Refrigeration Institute (AHRI) in response to the U.S. Department of Energy's (DOE) notice of public meeting and availability of the framework document appearing in the Federal Register on February 1, 2013.

AHRI is the trade association representing manufacturers of heating, cooling, water heating, and commercial refrigeration equipment. More than 300 members strong, AHRI is an internationally recognized advocate for the industry, and develops standards for and certifies the performance of many of the products manufactured by our members. In North America, the annual output of the HVACR and water heating industry is worth more than \$20 billion. In the United States alone, our members employ approximately 130,000 people, and support some 800,000 dealers, contractors and technicians.

This rulemaking is of great importance to AHRI members. In general, we believe that the furnace fan test procedures in the supplemental notice of proposed rulemaking (SNOPR) are a significant improvement over the test procedures specified in DOE's May 15, 2012 notice of proposed rulemaking (NOPR). However, additional changes are necessary to the SNOPR in order to ensure that the testing burden imposed on manufacturers is not unnecessarily prohibitive.

DOE's proposed Fan Energy Rating (FER) metric is comprised of two distinct furnace operation descriptors – the first is calculated from electrical energy measurements at three separate test conditions and the second is airflow at a single test condition. We believe that the airflow component of the FER metric is secondary in importance and is meant to simply provide a frame of reference. In this SNOPR, DOE has focused on increasing the accuracy of measurements related to the airflow component of the FER metric and we believe that some of DOE's proposed modifications to AHRI's proposed test procedure would increase the testing burden on the industry while adding little or no benefit. We strongly urge that DOE not require furnace manufacturers to measure an additional steady state efficiency to calculate the FER metric because it would impose an additional testing burden.

Manufacturers already measure the steady state efficiency at an external static pressure determined at mid-rise (which is different from the conditions proposed in DOE's SNOPR) in order to calculate the AFUE metric.

We are strongly opposed to DOE's proposal to modify the FER equation by eliminating the heat capacity ratio from the denominator. The SNOPR does not provide a scientific justification for such a modification and unnecessarily penalizes the FER associated with multi-stage and modulating units. We believe that the FER equation should be:

$$FER = \frac{(CH \times E_{Max}) + (HH \times E_{Heat}) + (CCH \times E_{Circ})}{(CH + HH + CCH) \times Q_{Max}} \times 1000$$

We believe that in order to implement the new requirements on a timely basis while minimizing the burden on furnace manufacturers, the option of employing an alternative efficiency determination method (AEDM) to determine FER must be made available instead of mandating that a minimum of two samples be tested in order to achieve DOE certification. Additionally, DOE should allow also the use of the AEDM provision to the AFUE metric.

We continue to maintain that modular blowers are not currently a federally regulated product and should be excluded from the scope of this rulemaking. If 42 USC § 6295(f)(4)(D) was intended to cover this equipment, then there would have been a corresponding change to the definition of furnace or the addition of this product class along with a direction to develop a corresponding test procedure. The absence of any such legislative change is contradictory to the SNOPR's proposed coverage of modular blowers. Additionally, the proposed test procedures in the SNOPR are insufficient for modular blowers and fail to account for the fact that some modular blowers in today's marketplace are not even designed to operate with electric heat resistance kits.

The note under Appendix AA to Subpart B of Part 430 on page 19625 of the SNOPR should be revised to clarify that it pertains to the FER rating metric. We propose that the first sentence of the note be modified in the following manner:

Note: Any fan energy rating (FER) representation made after September 30, 2013 ~~for energy consumption of furnace fans~~ must be based upon results generated under this test procedure.

Lastly, we have the following specific responses on the issues on which DOE seeks comment:

Issue 1 – Airflow Equation

Although we agree with DOE's assertion that measuring the steady state combustion efficiency and fuel energy input at the proposed operating conditions is more accurate than using AFUE and Q_{IN} , we believe that using nominal values associated with AFUE (which also accounts for jacket losses) and Q_{IN} to calculate airflow is a conservative approach and will eventually lead to conservative FER values. Additionally, using AFUE and Q_{IN} reduces the testing burden on manufacturers, as compared to measuring steady state combustion efficiency and determining jacket losses, which could take up to two additional hours for every basic model.

We are also concerned that the test procedures specified within this SNO PR could require that a manufacturer test the steady state efficiency and jacket losses of a furnace at a new and higher external static pressure operating point. Today the AFUE metric is determined at the external static pressure prescribed in section 8.4.2.1.3 of ANSI/ASHRAE Standard 103-1993, and the same approach is maintained in ANSI/ASHRAE Standard 103-2007 as well. This AFUE test operating point is related to the mid-rise operating point which is referenced extensively in the ANSI Standard Z21.47/CSA 2.3 for gas-fired central furnaces. The ANSI Standard Z21.47/CSA 2.3 requires that the furnace stop operating at temperature rise conditions which are 100 °F above the rise range listed on the furnace rating label. It is possible that the furnace will run without the required safety controls in place under a higher external static pressure condition.

We agree with DOE that air properties can vary during tests and suggest that DOE consider the use of a conversion factor that is adjusted by barometric pressure at test conditions.

Issue 2 – Using Temperature Rise in the Rated Heating Airflow-Control Setting To Calculate Maximum Airflow

DOE states in its SNO PR that the maximum airflow-control setting is often designated for cooling operation and not heating and then proposes to modify the AHRI recommended method to specify that maximum airflow be calculated based on a temperature rise measurement taken while operating the furnace in the rated heating airflow-control setting and firing the burner at the heat input capacity associated with that airflow control setting. The issue with such an approach is that there is an assumption that the cooling airflow rate can be calculated using the measured temperature rise in the heating mode. This assumption is not substantiated in the SNO PR.

We are strongly opposed to DOE's k_{ref} concept because it introduces an unsubstantiated assumption that the system curve is a parabola that can be generated based on a single data point. We continue to recommend that the furnace is fired at the maximum airflow rate to calculate Q_{max} .

Issue 3 – Using the Maximum Heat Setting to Measure Temperature Rise

We disagree with DOE's assertion that operating a multi-stage furnace at the maximum heat setting would result in a higher temperature rise. There are instances where the temperature rise at a reduced heat setting is higher than the temperature rise at the maximum heat setting.

Issue 4 – Elevation Impacts

We agree with DOE that higher elevations would have an impact on temperature rise and calculated airflow. We believe that the maximum test elevation should be 2000 ft and recommend that furnace fans should not be tested above 2000 ft without an appropriate adjustment to the test conditions and calculations. At elevations above 2000 ft, the National Fuel Gas Code, ANSI Z223.1/NFPA 54 specifies high altitude adjustments to the burner input.

Issue 5 – Outlet Duct Restriction Specifications

Historically, the industry has not faced any issues with respect to external static pressure measurements. Although we believe that a symmetrical duct restriction is needed in order to achieve repeatable results, we believe that DOE does not need to specify the methods for restricting the outlet duct. The material that goes into restricting the outlet duct is irrelevant and the manufacturer should be allowed to determine the type of material that would lead to symmetrical restrictions on the outlet duct.

Issue 6 – Optional Return Air Duct

We agree with DOE's proposal to allow for the optional use of a return air duct. The industry currently follows the duct and plenum arrangement specified in Figure 2 of ANSI/ASHRAE Standard 103-1993. We believe that there is no need for DOE to specify any duct requirements in addition to those specified in ANSI/ASHRAE Standard 103-1993.

Issue 7 – ASHRAE 37–2005 External Static Pressure Measurement Provisions

We agree that the DOE test procedures should provide a detailed specification and a diagram for measuring the external static pressure. However, using the provisions in ANSI/ASHRAE Standard 37 unchanged may require a duct that is too tall for the ceiling height of a laboratory that is used for testing furnaces. Based on a survey that we recently conducted of our members, we agree that the four tap arrangement in ANSI/ASHRAE Standard 37 is appropriate as it provides a repeatable average pressure reading. We also recommend that these pressure taps be placed 18 inches from the furnace outlet to ensure that the measurements are repeatable.

Issue 8 – Temperature Measurement Accuracy Requirement

Although certain temperature data acquisition systems are capable of ± 0.5 °F accuracy, many typical temperature sensors that are used by manufacturers do not have the capability of maintaining such a high level of accuracy. Hence, we recommend that DOE not specify an error of ± 0.5 °F. We believe that special limits of error (SLE) T-type thermocouples are appropriate for temperature rise measurements. Per Table 1 of ANSI/ASHRAE Standard 41.1-2013, these thermocouples have an accuracy of ± 0.9 °F.

Issue 9 – Minimum Temperature Rise

Although we do not feel that a minimum temperature rise is required, we agree that a minimum temperature rise of 18 °F is reasonable.

Issue 10 – Steady-State Stabilization Criteria

We believe that the steady-state stabilization criteria proposed by DOE are not reasonably achievable. Increasing the stringency of the steady-state stabilization criteria will greatly increase the time it takes to run the test. We also feel that it will increase the testing burden on manufacturers without significantly improving the accuracy of the results. The industry has managed to produce consistent test results by using the current stabilization criteria, which have been a part of DOE's residential furnace test procedure for many years. DOE's

proposed changes to the steady-state stabilization criteria do not provide any additional evidence that there would be a significant improvement in the accuracy of the calculated airflow. Hence, we recommend that DOE not make any modifications to the existing steady-state stabilization criteria in the DOE test procedure for residential furnaces.

Although sections 8.4 and 8.5 of the SNOPR propose four successive temperature readings taken 15 minutes apart, we believe that a process that involves three temperature readings taken 15 minutes apart is more than adequate for electric furnaces and cold flow tests. As stated earlier in this letter, we believe that modular blowers should be excluded from the scope of this rulemaking.

Issue 11 – Inlet and Outlet Airflow Temperature Gradients

Although we agree with DOE that airflow temperature gradients are likely to be present at the outlet, the use of a mixer, as depicted in ANSI/ASHRAE Standard 41.1-1986 (RA 2001) is typically not practiced in the field. We are opposed to the use of a mixer as proposed by DOE since it would have an impact on the external static pressure values. Our members have extensively reviewed the ANSI/ASHRAE Standard 41.1-1986 and have concluded that it is an unsuitable standard for mixing air. They have analyzed mixers using computational fluid dynamics technology and have determined that any suggested configuration within the standard simply stirs the air and does not mix it. Hence, the gradient remains and is only displaced. We feel that mixing cannot occur without significant pressure drop in excess of the capability of most psychrometric rooms that are available today and the pressure drop required for adequate mixing exceeds the external static pressure values required for FER testing.

We also believe that the air temperature can be adequately measured by the thermocouple arrangements that are specified in the ANSI/ASHRAE Standard 103-1993. No additional thermocouples are needed to measure the air temperature since the temperature grid specification described in Figure 2 of ANSI/ASHRAE Standard 103-1993 and the use of average temperature measurements within that standard have provided very consistent results over many years. There is insufficient data to prove that the use of a mixer will improve measurement of temperature rise as compared to the existing practice of averaging the temperature measurements. In addition, mixers are not readily available or used by all manufacturers.

Issue 12 – Sampling Plan Criteria

We agree with DOE's proposal to adopt a sampling plan that requires any represented value of FER to be greater or equal to the mean of the sample or the upper 90 percent (one-tailed) confidence limit divided by 1.05. However, the sampling plan for the DOE enforcement testing of residential furnaces employs a statistic that is based on a 95 percent two-tailed probability level with degrees of freedom ($n_1 - 1$), where n_1 is the total number of tests. In order to ensure that manufacturers are not set up for failure, DOE must ensure that the confidence limits with respect to the certification and enforcement testing of the FER metric are the same. The additional stringency in enforcement testing is inconsistent with the proposed certification requirement and creates a real likelihood that FER values properly certified to DOE could subsequently be identified as invalid values during enforcement testing.

AHRI appreciates the opportunity to provide these comments. If you have any questions regarding this submission, please do not hesitate to contact me.

Sincerely,

A handwritten signature in black ink, appearing to be 'AR' with a flourish underneath.

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